

What is claimed is:

1. A fuel injection pump for an internal combustion engine, the fuel injection pump comprising:

a pump housing that defines a pump chamber therein;

a hydraulic timer mechanism that is received in the housing and adjusts fuel injection timing based on fuel pressure of the pump chamber; and

a load timer mechanism that is received in the housing and adjusts the fuel injection timing based on a load of the engine, wherein the load timer mechanism includes:

a governor shaft that is secured to the housing, wherein the governor shaft includes:

a fuel relief passage that is communicated with a low pressure side of the fuel injection pump and has an outer opening in an outer peripheral surface of the governor shaft; and

a first annular groove that is recessed in the outer peripheral surface of the governor shaft such that the first annular groove is axially displaced from the outer opening of the fuel relief passage; and

a governor sleeve that is axially slidably supported around the governor shaft and is moved back and forth relative to the governor shaft based on the load of the engine, wherein the governor sleeve includes:

a port that extends between an outer peripheral surface and an inner peripheral surface of the governor sleeve and includes an outer opening placed in the outer peripheral

surface of the governor sleeve and an inner opening placed in the inner peripheral surface of the governor sleeve, wherein the port conducts the fuel pressure of the pump chamber from the outer peripheral surface to the inner peripheral surface of the governor sleeve; and

a second annular groove that is recessed in the inner peripheral surface of the governor sleeve such that the second annular groove is axially displaced from the port, wherein:

when the governor sleeve is positioned within a predetermined axial range, the first annular groove and the second annular groove are at least partially overlapped one another to define a fuel pool therebetween;

when the engine is in one of a full load condition and a high load condition, the first annular groove and the second annular groove are at least partially overlapped one another, and the fuel pool is not substantially communicated with the port to prevent substantial communication between the port and the fuel relief passage;

when the engine is in one of a partial load condition and an intermediate load condition, the first annular groove and the second annular groove are at least partially overlapped one another, and the fuel pool is substantially communicated with the port to substantially communicate between the port and the fuel relief passage; and

when the engine in one of a no load condition and a low load condition, the first annular groove and the second annular groove are not substantially overlapped one another to prevent

substantial communication between the port and the fuel relief passage.

2. The fuel injection pump according to claim 1, wherein at least one of the inner opening of the port and the outer opening of the fuel relief passage is formed as an annular groove.

3. The fuel injection pump according to claim 1, wherein:  
the governor sleeve further includes a protrusion, which is formed in the inner peripheral surface of the governor sleeve between the inner opening of the port and the second annular groove; and

an axial extent of the first annular groove is larger than an axial extent of the protrusion of the governor sleeve.